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Responsive Industrial Support Exists

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by

Randel L. Zeller
Commander, USN

A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirement of the Department of Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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RESPONSIVE INDUSTRIAL SUPPORT EXISTS

Chapter I

Introduction

The opinion that American industry can not provide timely support to the military across the spectrum of military conflict is false. The advanced manufacturing technology currently installed in American factories represents a vast pool of untapped military surge capability. Impressive advancement in manufacturing technology over the past few years also provides excellent computer analysis capability to the field and theater commander. The changes in industry have been extraordinary. The military must change its view of industry to take advantage of it.

Modern manufacturing technology and computer design products delivered by defense contractors provide the operational commander an array of unique capabilities. Using existing and emerging technology commanders can 1) evaluate hardware performance in any environment, 2) design and test improvements necessary to enhance equipment performance, 3) accurately anticipate scenario driven logistical requirements, and 4) plan scenario driven industrial surge production.

The case study for this discussion is a hypothetical operational scenario involving the M1A1 tank. In developing an OPLAN for a regional conflict the theater CINC desires to build a plan around the fire power of an Army heavy division. The terrain in which the heavy division will operate is rugged. The region temperature varies extremely between summer and winter. Using a Computer Aided Engineering (CAE) model developed by the M1A1 manufacturer the CINC planning staff places the tank in the expected environment. By stressing the tank CAE model through the extremes of temperature, altitude, humidity, speed and workload anticipated the planner gets a dynamic indication of tank performance. The feasibility of M1A1 employment in the proposed scenario is an immediate product of this evaluation. Another outcome of the CAE model is a unique list of equipment failure probabilities for the proposed employment scenario. From this the planner develops an accurate listing of needed spare parts and consumables. In the event the planning staff finds that the tank will require an environmental or mission specific modification, the ability to design and test this modification is immediately available. As a result of consulting the CAE model the OPLAN now includes a list of necessary spare parts to support the mission as well as any special equipment modification. As execution of the OPLAN becomes more likely, the CINC can direct specifically how industry must surge to support him. Computer Aided Manufacturing (CAM) technology

in American industry provides the CINC an industrial base ready to meet his surge requirements. The CINC can also communicate needed equipment modifications to the manufacturer directly using the designs developed by his planning staff. What follows is an in-depth exploration of this capability.

Chapter II

Mobilization Impact

The Deliberate Planning Procedure employed today at the CINC level makes the assumption that industrial mobilization will not be quick enough to influence the early phases of a conflict. The CINC OPLANS and CONPLANS produced in response to JSCP tasking therefore plan for a fight using available resources. This narrow view of industrial responsiveness is antiquated and is influenced by the impressions left from previous industrial mobilization efforts.

Mobilization History

"The war was decided by engines and octane." - Joseph Stalin

History has shown that United States industry is ill prepared to react to wartime mobilization requirements. When United States troops deployed to France toward the end of the first World War, American industry had barely begun to mobilize for wartime production. Even after years of fighting in Europe and obvious warning that United States involvement was inevitable, the United States could send little more to France than men to help fight the Germans. In 1953, Harry B. Yoshpe, working on a case study for the National Security Resources Board, summarized industrial

mobilization for WWI. "Notwithstanding our potential strength in material and human resources and our opportunity to observe for some 3 years the struggle abroad, we entered WWI, as we did all other wars in our history, virtually unprepared."¹

American industrial mobilization saw its finest hour during WWII. President Roosevelt's "Lend Lease" program to supply Great Britain, served to mobilize United States industry a full 2 years before the Japanese attack on Pearl Harbor. The reaction by "Fortress America," with this two year head start, was remarkable. By the end of WWII, the military portion of GNP was approximately 45%. American industry was achieving an annual production rate of 50,000 aircraft, 20,000 tanks, 80,000 artillery pieces, and 500,000 trucks.²

The first and only industrial mobilization in the nuclear age came as a result of the Korean War. This painful mobilization continues to influence our view of industrial responsiveness today. At the end of WWII the United States and the Allies rapidly demobilized their military and industry. The Soviet Union on the other hand did not and held fast to the countries it occupied in

Notes

¹Harry B. Yoshpe, A Case Study in Peacetime Mobilization Planning, (Executive Office of the President, 1953), p.1.

²Roderick L. Vawter, Industrial Mobilization: The Relevant History, (Washington: National Defense University Press, 1983), p. 2.

Eastern Europe. In response to the Soviets achieving an atomic explosion in August 1949, and their maintenance of great conventional power, President Truman moved to improve the security posture of the United States. President Truman's initiative resulted in the issuing of NSC-68 in early 1950. "NSC-68 predicted that United States economic superiority would erode and proposed that the United States take the lead in developing a healthy international community and a strong military to inhibit a Soviet attack."³

NSC-68 pointed out that the rapid demobilization of the United States following WWII had left American industry unprepared for a war with the Soviet Union. After the North Korean invasion of the South it took the United States over 2 1/2 years to mobilize industrial production to respond. The Truman Administration artificially limited military production to avoid overwhelming the United States economy with government spending. Thus a more gradual expansion in the military contribution to GNP was pursued.⁴

In the early months of the Korean War, supply from the United States could not meet all the needs of the Far East Command. The large quantities of equipment collected at the end of WWII in Japan supplied the troops in South Korea until United States transportation and industry could

³Vawter, p. 25.

⁴Ibid., p. 25.

respond. Seventy percent of the general purpose vehicles, 45% of the tanks, and 82% of all other combat vehicles used by the allies during the first months of the war came from these stockpiles in Japan.⁵ A serious shortage of artillery ammunition caused the Eighth Army to reduce its rate of daily artillery fire during the winter and spring of 1952 to conserve dwindling stockpiles.⁶

This industrial mobilization effort had a major effect on the Cold War as well as the war in Korea. This in spite of the fact that not a single medium tank produced specifically for the Korean War actually made it to the battlefield.⁷ It included the initiation of major strategic programs like the B-47, B-52, Atlas, and Polaris.⁸ The Government spent \$5.7 billion to expand dedicated defense production facilities and provided various incentives to expand basic industry by \$23.1 billion.⁹ This mobilization had again demonstrated to the Soviet Union that the United States continued to be the "Arsenal of Democracy." "Policy

⁵Terrence J. Gough, U.S. Army Mobilization and Logistics in the Korean War, (Washington: Center of Military History - U.S. Army, 1987), p. 59.

⁶Ibid., p. 59.

⁷College of the Armed Forces, The Ability of the Industrial Base to Mobilize - Historical Lessons Applied to Contemporary Policies and Organization, (College of the Armed Forces - 1983), p. 62.

⁸James P. Bell, Industrial Base Actions in a Period of Rising Tensions, (Institute for Defense Analysis - Program Analysis Division - August 1982), p. 8.

⁹Ibid., p. 8.

makers hoped that maintaining this mobilization capability would convince the Soviets that, in the event of war, any early Soviet successes would be overwhelmed by the industrial might of the United States."¹⁰

The significant gains made during the Korean War in industrial base preparedness were short lived. In "Industrial Mobilization: The Relevant History," Roderick Vawter summarized the neglect and ill management of the industrial base in the late 1950's and the 1960's.

"In 1955, the Air Force adopted the Force-in-Being concept, which was predicated on the assumption that the next war would be a total nuclear war fought with the weapons on hand at the start. The focus was on achieving a constant state of readiness and logistics in place, to provide a nuclear deterrent and massive retaliation. From 1958 to 1967, the Air Force conducted no industrial readiness planning with industry except the planning inherent to the procurement cycle. This philosophy change sent mixed signals to industry. The Army and Navy on one hand were planning for industrial mobilization with industry while the Air Force said it was unimportant. The net effect was an erosion of interest in the idea by industry."¹¹

Mobilization Lessons Learned

An important lesson that came out of both of the mobilizations associated with WWII and the Korean War is the

¹⁰Mackubin T. Owens, "Expand the Military-Industrial Complex? Yes - Preparedness Requires It," Orbis, Fall 1989, p. 540.

¹¹Vawter, p. 48.

importance of industrial flexibility. It proved key to our ability to shift to war material production. Most of industrial production focuses on assembly type operations. Therefore the manufacturing base of the economy offered an inherent degree of flexibility from which to draw. Existing plants were convertible to the military production of products similar to their commercial output. Once shifted to wartime production military industrial output grew with the availability of raw materials. As a result the initial effort of mobilization directed the expansion of basic industries such as steel, aluminum, petroleum, chemicals, and electrical power.

In the shift toward war production a major bottleneck developed within the machine tool industry.¹² Machine tools shape, form, or process metals into other machines. Changing an assembly lines from commercial to military production required retooling. The bottleneck in the output of the machine tool industry affected production throughout the country. After this portion of the economy expanded military production finally grew to meet operational demand.

Each of the mobilization efforts of this century presented a number of problems unique to their times, but a common thread is evident. After each successive war the nation vowed to maintain the defense industrial base at some level of preparedness. The cost of doing so was

¹²Ibid, pp. 25 - 28.

considerably less than that required to rebuild the base in response to a national emergency. In January 1953, while the Advisory Committee on Production Equipment was finally bringing major portions of the industrial base into wartime production, the Committee offered a recommendation for future planners.

"Substitute, to the greatest extent practicable, production capacity for the stockpiling of military end items....If an adequate defense position has to be maintained over an extended period of time, as now seems to be the case, productive capacity to produce military end items must be created and thereafter must be maintained in such a condition that it can be quickly expanded in the event of an emergency by merely adding manpower and hours of operation."¹³

The Vance Committee, or the Advisory Committee on Production Equipment, had a far reaching impact on the present view of the defense industrial base. Its recommendations were the foundation for DOD defense mobilization planning until the mid-1970's.

Many of the Vance Committee recommendations, as well as other mobilization lessons learned in response to the Korean Conflict, became law in August 1954 with the Defense Mobilization Order VII-7. This order declared that it is essential that all means of wartime production be maintained in such a manner to permit rapid mobilization in the event of a national emergency. This includes assets such as

¹³Ibid., p. 31.

facilities, machine tools, production equipment, and skilled workers. The Department of Defense received direction to identify all facilities and producers that could support war time mobilization. Selected companies from this group would be maintained to the fullest extent possible by the effected service through investment and cooperation. Other directives authorized the payment of higher-than-low-bid price if a benefit to national security would be realized.¹⁴

It was obvious to the Vance Committee that the nation needed an industrial base responsive to the needs of the military. The military on the other hand ignored the committees' advice and expanded the nuclear "Force in Being" philosophy to include conventional arms. Outside the procurement cycle the defense industrial base generated little concern. As a result today's military commanders have totally separated military industrial production from their own concept of warfighting. The belief that the war will be over before industry can respond to the needs of the front is widely held. It has biased the view of where industry fits in CINC planning for war. A summary of the institutional view of industrial responsiveness is:

"American industry today is unable to expand its production to meet wartime mobilization needs in less than eighteen months. It is not possible to surge the output of even the most important weapons and war material much faster than that. The nation has been dependent for years on foreign sources of raw materials. Now it is becoming

¹⁴Ibid, p. 38.

dependent for critical manufacturing goods as well, including some high-technology products that are essential to defense production. Although the United States is still ahead in the international balance of military trade, its relative advantage is declining."¹⁵

This view of how crippled industry is to provide responsive support to the military is antiquated and false. To compete in the world economic environment American industry has had to modernize. This modernization has actually improved American competitiveness worldwide. The plan proposed in the mid-50's to improve manufacturing responsiveness to the military has come to pass quite naturally as technology has improved and as a result of free market forces. An industrial base responsive to the needs of the military has for the most part grown on its own. It is interesting to note that defense contractors are actually setting the pace in this field.

¹⁵The Air Force Association, Lifeline in Danger, (The Aerospace Education Foundation - September 1988), p. i.

Chapter III

Computer Aided Manufacturing

The operational commander can capitalize on the renaissance in production that is going on in American manufacturing. More and more major corporations, as well as small producers, are modernizing their production capability through adoption of the computerized assembly line. Computers are playing an increasingly important role in every aspect of manufacturing.

The most fundamental tool to all manufacturing is the engineering drawing, the blueprint. Over 90% of the data produced and maintained by a company involved in manufacturing is in the form of engineering drawings.¹⁶ Drawings are produced by the conceptual designer and used or modified by the preliminary design engineer, the production engineering designer, the manufacturing numerical control (NC) programmer¹⁷, the tool designer, the template maker, and quality control and production support personnel. Engineering drawings are studied and used extensively at

¹⁶Stephanie J. Cammarata, An Object-Oriented Data Model for Managing Computer-aided Design and Computer-aided Manufacturing Data Bases, (University of California - 1986), p. 14.

¹⁷Numerically controlled machines read data from a paper or magnetic tape to produce a product. For example, a NC wood lathe could turn a banister spoke down based on a pattern specified on a paper tape.

every level of production and are key to a successful manufacturing effort. On the Lockheed TriStar L-1011 there are over 250,000 engineering drawing related to the aircrafts' electrical system.¹⁸

In 1963 General Motors introduced the first computer aided design (CAD) system, DAC/1 (Design Augmented by Computers).¹⁹ With that first step CAD has since revolutionized manufacturing. In today's progressive manufacturing environment the computer screen has replaced the drafting table as the basic tool of design. Instead of going on paper the design goes on the computer screen. The vast numbers of engineers and production personnel that once poured over blueprints as they conducted their phases of the manufacturing process now refer to their computer screen. There they find a set of computer programs and tools that not only presents them the 2-dimensional engineering drawing of the product but permits them to view the product as a 3-dimensional solid. The computer also simulates the product's response under load, motion, heat and the other conditions under which the product will operate. This process is conducted before the product is ready for production line fabrication. Once the design is finalized the computer screen is used by production personnel to actually control the machinery used to produce the product.

¹⁸S.J. Smyth and A.N. Baker, The CADAM System - The Designers' New Tool

¹⁹Cammarata, p. 2.

Computer-aided Manufacturing (CAM) was integrated with CAD in the late 1960's by Lockheed-Georgia to develop a computer drafting system for numerical control (NC) parts production.²⁰

Today CAD/CAM and Computer-aided Engineering (CAE) technology is rich with return possibilities. The computerized assembly line offers a high quality output plus the flexibility to respond to both design and product changes.

The National Bicycle Industrial Company (a subsidiary of Matsushita of Japan) has put CAD/CAM to use in a unique manner. With a staff of 20 people and a computer driven assembly process, National can produce a custom-made bicycle frame and gears for roughly the same price as other manufacturers charge for off-the-shelf equipment. The factory claims it is ready to "produce any of 11,231,862 variations on 18 models of racing, road, and mountain bikes in 199 color patterns and about as many sizes as there are people."²¹ To obtain one of these bicycles the customer is measured in the bicycle shop. Those specifications are telephoned to the factory and used to produce a blueprint on the in house CAD system. This system in turn drives the manufacturing equipment that builds the bike. Turn around time is about two weeks (each bike takes actually 3 hours to

²⁰Ibid. p. 2.

²¹Susan Moffat, "Japan's New Personalized Production," (Fortune - October 1990), p. 132.

make).²² A bicycle factory using conventional manufacturing methods takes approximately 90 minutes to produce a standard high quality bike. This flexibility was unheard of before the advent of computer aided manufacturing.

As CAD/CAM is revolutionizing private manufacturing it is also changing how operational commanders should view the national industrial base.

"What the U.S. Military requires of this industrial base is to maintain a technological edge over potential adversaries; then in time of war, to meet the needs of national security in a timely and economical manner. At minimum, this means efficient peacetime production, support for the military's existing force structure and war reserve, and surge capacity (rapid expanding production within the existing industrial plant)."²³

By using the National Bicycle Industrial Company as an example it is easy to see how factories with computer driven assemble lines could shift quickly to defense related production of similar products. It is not difficult to conceive of a scenario in which an electronics company heavily dependent on CAD/CAM for private production could shift quickly to defense related surge production. This surge could meet the anticipated requirements of any number of high technology weapon systems. If the manufacturer's

²²Ibid., p. 132.

²³Owens, p. 541.

capabilities were known ahead of time, and his assembly line had the raw materials readily available, production specifications for the critical defense related components could be sent via the telephone directly into the factory's CAD/CAM system. The needed surge in production capacity would be expected to soon follow.

At Lockheed over half the total number of parts required to build the TriStar L-1011 and the S-3 Viking were produced using the company's CAD/CAM system.²⁴ Other companies with similar manufacturing capabilities could contribute to cut Lockheed's lead time on the S-3 by using the designs from Lockheed to drive their own CAM systems. Those parts could then either be shipped to Lockheed as individual parts or as subassemblies. The parts could also be put right into a CINCs logistics pipeline to support ongoing military operations. This approach would multiply many fold potential S-3 aircraft and/or spare parts output. Since CAD/CAM technology is becoming common place in every field of manufacturing the potential exists that every producer in the United States, in one way or another, could be mobilized in time of war. The one year required for the Machine Tool industry to expand its capability, and clear out the significant backlog that resulted from the Korean War mobilization, could be cut to days or weeks with the aid of a CAD/CAM system. In most cases a CAD/CAM assembly line

²⁴Smyth and Baker, p. 39.

retools by changing a computer program. As a result the time required for industry to response to the warfighting needs of a commander could also be expected to be cut significantly.

CAD/CAM technology is not without its problems. In the past 10 years there has been a virtual explosion in the number of CAD/CAM systems available. Every major producer of computer hardware systems has either developed independently or teamed with other companies to produce its own version of the CAD/CAM workstation. Computer software companies have also entered the market introducing an even greater number of different CAD/CAM computer software packages. The CAD/CAM workstation is as a unique combination of both hardware and software. This workstation is essentially a stand alone computerized drafting system with its own computer graphics monitor, keyboard and drafting pad, and computer. The computer program that is used to produce the product design is referred to as an application. CAD/CAM applications include programs for drafting, 3-D modeling, engineering modeling, and so on. The major problem with all these independent systems is that they are not compatible. Engineering drawings produced with one unique system (hardware and software combination) can only be used on other systems with an identical hardware and software combination.

CAD/CAM "systems are constructed from separately developed computer programs. Often these programs are written in different programming languages to run on different computer systems, offer different user interfaces, and store the results of their analysis or simulation in a way that precluded information sharing between programs."²⁵

Electric Boat Division (EB) and Newport News Shipbuilding and Dry Dock Company (NNSB&DD) present a good example of how this problem effects a current defense program, the Seawolf Class SSN (SSN21). The design of the SSN21 is divided between the two contractors mentioned. EB is responsible for designing the aft half of the ship and NNSB&DD is responsible for the front. EB uses a CAD/CAM system produced by Computervision and NNSB&DD uses a system produced by Lockheed called CADAM (Computer-graphic Augmented Design and Manufacturing). By government contract requirement the two system outputs must be compatible. Compatibility is achieved by each company supporting a common computer data base output format call IGES (Initial Graphics Exchange Specification). Through IGES CAD/CAM systems at EB and NNSB&DD can communicate. Pointed out in an interview with Chief Design Engineer Robert Watrous at EB is that although IGES links EB to NNSB&DD it is a time consuming process and is not 100% compatible. Information is lost when IGES is used. Additional manpower is therefore

²⁵Duane R. Worley, A Methodology, Specification Language and Automated Support Environment for Computer-Aided Design Systems, (University of California, Los Angeles - 1986), p. 203.

required to correct the data transfer problems before the information can be used.

Problems associated with CAD/CAM system compatibility are not limited to the intra-company level, it is also an inter-company problem. Companies are finding that their investment in a variety of CAD/CAM systems, or in simple system upgrades, is threatened by the incompatibility of the various hardware/software data bases. The "by words" today in industry when discussing CAD/CAM are; "common data management", "networking facilities", and "integration of the work station to large company databases." In this effort Boeing embarked on producing the Boeing Computing Support Systems (BCSS) in 1980. "BCSS will integrate production definition data, such as two-dimensional and three-dimensional geometry; product properties; bill of material information; job and process specification; tool definition; and inspection and testing sub-systems."²⁶ Full implementation is expected in 1995. Lockheed's CADAM system is currently considered the industry standard in CAD/CAM integration. CADAM is taught at major engineering colleges and universities at both the graduate and undergraduate level.

In recent years Department of Defense procurement agencies have worked to establish standards for the various data bases produced by defense contractors. The result of

²⁶Cammarata, p. 162.

this effort will produce a universal CAD/CAM/CAE software standard for use in defense related production. It is assumed that a company doing business with the government will be required work within this standard. It follows that when a contractor delivers his product to DOD the supporting CAD/CAM/CAE software will also be turned over.

Chapter IV

Case Study Evaluation

The preceding discussion served two purposes; first to review the historic circumstances that have shaped our view of defense industrial production, and second to introduce the latest manufacturing technology. In returning to the simple M1A1 case study I will show that industrial production is as much of a concern for the operational planner as it is to the force planner. A shrinking defense budget makes this a necessity. Surging industrial capability to meet the needs of the operational commander or the theater commander to deal with a regional conflict is a logistics matter not a mobilization one. Advanced manufacturing technology puts the actual hardware producer in the CINCs logistical pipeline. Industry is available for immediate tasking, with a reliable degree of responsiveness.

This responsiveness begins with the Defense Department's hardware procurement system. When DOD now contracts for weapon system production a great deal more than equipment is delivered. Obvious items such as training, spare parts, and documentation follow the equipment into the field. A less obvious product is millions of hours of the manufacturers' design and engineering work. Until recently this was limited to the form of weapon system engineering drawings. With the advent

of Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) and Computer Aided Engineering (CAE) these products now take the form of an extensive computer data base. As the DOD standard language for this data becomes established the power of this technology will be exploitable at the operational level.

The M1A1 case study assumes that the tank was designed and produced in a CAD/CAM/CAE environment. Even if this was not the case it is a relatively inexpensive matter to take existing physical engineering drawings and convert them to the DOD standard CAD/CAM/CAE data base format. This case study also assumes that the CAD/CAM/CAE data base is available to the operational planner in a format to allow easy manipulation and evaluation. This is currently not the case because of the operator training required. Developing the necessary in house or staff expertise is a relatively simple matter.

In the M1A1 case study the CINC planner was able to put the tank through a series engineering evaluations based on a projected operational environment. An important product from this evaluation is a list of probable spare parts needed to support the tank on the projected mission. The tanks' CAE model also includes information that designers would have previously passed in the form of design notes on the engineering drawing. A change in a preventive maintenance requirement would be an example. Since preventive maintenance causes the consumption of air

filters, oil filters, lubricants, and the like to change the planner is also alerted to another mission specific logistical requirement.

During the Allied invasion of Normandy field commanders found that their tanks had a difficult time penetrating the Normandy hedgerows. Engineers in theater designed, fabricated, and installed plows on Allied tanks to correct this problem. The CINC planner may be faced with a similar scenario driven design change requirement while evaluating M1A1 CAE model performance. Using the M1A1 CAD data base the operational planner can design a fix to the problem. That modification can then be evaluated using the M1A1 CAE model. The modification can be produced in small numbers and at relatively low cost for field evaluation. This special equipment modification would then be added to the list of mission specific logistical requirements.

The true power embodied in CAD/CAM/CAE is its inherent responsiveness. As was mentioned earlier a major bottleneck in past industrial mobilizations resulted from the need to retool industry for military production. Until recently manufacturers had to rebuild their production equipment in order to change product output. In a CAD/CAM environment the assembly line is computer driven. Similar products can be produced using the same assembly line by simply changing the computer program that drives the process. Extensive retooling of industry to support industrial mobilization is no longer required. Assuming the Department of Defense and

the subordinate Services maintain a detailed list of supporting CAD/CAM facilities and their capabilities, shifting any or all to wartime or surge production is a relative simple matter.

In the M1A1 case study the CINC planner has developed an extensive list of mission specific logistical requirements. The list includes consumables, spare parts, and necessary equipment modifications. As the likelihood the OPLAN or CONPLAN will be executed increases the CINC planner can take steps necessary to surge industrial production to make up for shortfalls in required material. Identified manufacturers can shift their production to support the CINCs requirements in a matter of days. As the logistics system begins to draw the material needed to support the M1A1 in the CINCs theater industry is already producing replenishment stock. The same is true for mission specific modifications to the tank.

This technology has some less obvious advantages. With responsive industrial production CINC logistical planners are no longer required to stockpile an excessive number of spare parts and consumables. Knowing potential producer lead times the logistical planner can replace stockpiles with production capacity. Just as civilian airliners can be called into service to surge troop transport so can a CAD/CAM assembly line. The potential producer does not even need to have defense product design on site at the beginning of this process. The CINC logistical planner can transfer

necessary production data bases via the telephone lines to the manufacturers' computer.

Chapter V

Conclusion

A lesson learned over and over again is that the key to power projection is logistics. The recent crisis in the Persian Gulf demonstrated this point extraordinarily well. Desert Shield/Desert Storm also confirmed just how complex "logistics" is. Airlift, sea lift, strategic mobility, the "total force concept," all presented operational commanders with a greater management challenge than that experienced in fighting the war. A critical element in logistics, which was essentially ignored during this crisis because it is considered "too hard," was defense related manufacturing. This essential element of warfighting has often been considered a force planning problem not an operational one. Institutionally the military views industry response as too slow to play a role in power projection. This view is false. Had the United States and her allies been required to consume "smart munitions" for a protracted period of time our inability to manufacture these weapons could have had serious operational consequences. Detachment of manufacturing from our view of logistics fails to take advantage of a new reality. The advances in manufacturing technology, funded and developed largely through government contracting, puts industry squarely in the CINCs logistics pipeline. Industry can surge quickly and flexibly to

sustain a power projection effort across the spectrum of conflict.

The M1A1 case study used throughout this discussion highlights the operational significant of this technology. Production capacity can not in all cases replace the need to plan for, build, and stock pile weapon systems for the future. The CINC can immediately surge the production of spare parts and mission specific equipment modifications but not the manufacturing of a complete M1A1 tank. Wartime mobilization planning and preparation will still be a major concern for the force planners. Computer Aided Engineering (CAE) data bases developed in weapon system production are useful at every level of the operational command structure. Not only can the CINC study weapon system performance in a particular environment, but so can the motor pool.

The line that once divided industry from operational logistics must be re-examined. CAD/CAM/CAE based manufacturing makes factory production so responsive that OPLANS and CONPLANS can include mission specific manufacturing requirements. This technology replaces stockpiling with manufacturing capability and intelligent planning. It is capable of sustaining power projection from the factory instead of the warehouse. It will probably even save money.

End Note

In testimony before the House Armed Services Committee 12 March 1991 the Deputy Chief of Staff of the Armed Forces, Admiral Jeremiah, presented the concept of reconstitution of military power. With the conventional threat from the USSR apparently fading the need to maintain forces capable of responding immediately to Soviet aggression is considered too costly and therefore unnecessary. As the United States reduces the size of the military as international tension eases the Joint Chiefs hope to preserve the ability to "reconstitute" the military power lost. Prudent consideration of the world situation: a shift from a bipolar to a multipolar world, growing instability in the third world, and the search for direction in Eastern Europe, indicates that the United States may have to field an Army, Navy, and Air Force larger than that existing at the end of the Cold War.

The ability of the United States to reconstitute military capability will be used to replace standing military personnel and equipment. To be useful in defending the United States significant planning and attention will be required. Restructuring of the service reserve components and new thinking in officer and enlisted personnel recruiting and career patterns will result in the required reconstituted manpower pool. The reconstitution of the

combat equipment, complete with the latest in advanced technology, is a more difficult problem.

The industrial technology needed for Strategic Reconstitution currently exists. The strategy required for reconstituting high technology weapon systems, complete with operating doctrine and lessons learned from the field, requires the coordinated support of industry, the Joint Chiefs, the Commanders-in-Chiefs, and the various tactical development and procurement organizations. The mobilization base has been ignored in the past and will only support reconstitution will adequate attention. Industrial America must be considered an integral part of the logistic pipeline. The idea that the next war will be fought with what we have in our inventory and stockpiled at the beginning is no longer cost effective. High technology is too expensive and in some cases too perishable to be approached in this manner. Advanced manufacturing technology provides a base for developing the material and logistics side of Strategic Reconstitution. To make it work force planners and operational planners will have to work together and exploit this exciting technology.

Bibliography

- Bell, James P. Industrial Base Actions in a Period of Rising Tensions. Institute of Defense Analysis - Program Analysis Division, August 1982.
- Cammarata, Stephanie J. An Object-Oriented Data Model for Managing Computer-aided Design and Computer-aided Manufacturing Data Bases. Los Angeles: University of California, 1986.
- College of the Armed Forces. The Ability of the Industrial Base to Mobilize - Historical Lessons Applied to Contemporary Policies and Organizations. College of the Armed Forces, 1983.
- Gough, Terrence J. U.S. Army Mobilization and Logistics in the Korean War. Washington: Center of Military History - U.S. Army, 1987.
- Moffat, Susan. "Japan's New Personalized Production." Fortune, October 1990, p 132.
- Owens, Mackubin T. "Expand the Military-Industrial Complex? Yes - Preparedness Requires It." Orbis, Fall 1989, p. 540.
- Smyth, S. J. and Baker, A. N. The CADAM System - The Designers' New Tool.
- The Air Force Association. Lifeline in Danger. The Aerospace Education Foundation, September 1988.
- Vawter, Roderick L. Industrial Mobilization: The Relevant History. Washington: National Defense University Press, 1983.
- Worley, Duane R. A Methodology, Specification Language and Automated Support Environment for Computer-Aided Design Systems. Los Angeles: University of California, 1986.
- Yoshpe, Harry B. A Case Study in Peacetime Mobilization Planning. Washington: Executive Office of the President, 1953.